

REMARKS

In order to facilitate prosecution, Applicants have amended claim 1 to include preheating the reactant mixture discussed in the Office Action of December 11, 2003 at page 3. Support for this amendment is found the specification at page 3, lines 20-30 and page 5, line 32 and claim 1 as originally filed. No new matter has been added.

Applicants acknowledge that the rejections of claims 1-16 under 35 U.S.C. §§ 102(e)/103(a) as being anticipated or in the alternative obvious over U.S. Patent Publication No. 2002/0150532 (Grieve) and U.S. Patent No. 6,436,363 (Hwang) has been withdrawn.

Response to First Rejection Under 35 U.S.C. § 103(a)

Claims 1-6 and 10 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,524,550 (Chintawar) and U.S. Patent No. 6,342,465 (Klein). Applicants respectfully traverse this rejection for reasons made of record in the response filed October 28, 2003.

Applicants have amended the claims to include preheating the reactant mixture of hydrocarbons, oxygen and water or water vapor to a preheating temperature before passing the preheated reactant mixture over a catalyst adiabatically as discussed in the Office action page 3. Further, Applicants have amended the claims to include that the catalyst material contains at least one platinum group metal on an oxidic support material selected from the group consisting of aluminum oxide, silicon dioxide or mixed oxides thereof and zeolites.

Applicants find that the method of autothermal steam reforming using the claimed catalyst allows very high hydrogen productivity. See the specification at page 3, lines 13-15.

Chintawar may mention steam reforming, however, Chintawar does not disclose, teach or suggest a process for autothermal catalytic steam reforming of

hydrocarbons by: a) preheating a reactant mixture containing hydrocarbons, oxygen and water and then b) passing the preheated mixture over the catalyst that is operated adiabatically—without the removal or addition of heat.

Further Chintawar's catalyst is a different catalyst compared to the catalyst used in the claimed method. See summary of invention col. 4, lines: 59-63.

According to another aspect of the invention, the platinum group metal is supported on a material selected from the group consisting of **an oxide of zirconium, titanium and mixtures thereof. The preferable catalyst and support is Pt/ZrO₂.** (emphasis added)

By contrast, Applicants' oxidic support material is selected from the group consisting of aluminum oxide, silicon dioxide or mixed oxides thereof and zeolites. Applicants find that the method of autothermal steam reforming using the claimed catalyst allows very high hydrogen productivity. See the specification at page 3, lines 13-15.

Chintawar is directed primarily to catalysts used in a water gas shift reaction. See summary of invention col. 4, lines: 64-67:

According to another aspect of the invention, a water gas shift reaction can be accomplished in a reformat over a wide range of temperatures (for example, between about 200°C. to about 650°C) using a single shift catalyst.

Moreover, the catalysts used in the autothermal catalytic steam reforming process of the presently claimed invention has a coating of catalyst material containing the platinum group metal fixed on the oxidic support material. This is different from the catalyst of Chintawar that is produced by "the incipient wetness" impregnation method (col. 6, line 39). Thus, not only is the claimed method not disclosed in Chintawar, but also the presently claimed catalyst used in the autothermal catalytic steam reforming process not disclosed, taught or suggested in Chintawar.

With regard to Klein, the Examiner asserts that Klein is cited to show that catalysts are coated on the support. (Office Action, page 3) However, a prior art reference must be looked at in its entirety for its teaching. Klein discloses a process for preparing a catalyst that has a high catalytically active coating, which is used for cleaning automotive exhaust gases. See, example 1, and columns 9-10. Klein teaches the use of anionic salts of platinum group metals for pore volume impregnation. Klein does not disclose, teach or suggest a catalyst useful in an autothermal reforming process where a preheated reactant mixture of hydrocarbons, oxygen and water or water vapor, is passed over the catalyst adiabatically. In fact, Klein does not mention autothermal steam reforming at all.

Since Chintawar nor Klein discloses, teaches or suggests the present claims that include preheating the reactant mixture and passing it over the catalyst adiabatically, the present claims cannot be considered obvious. Moreover, one of ordinary skill in the art would not combine these two references together to obtain the present claims, since Chintawar does not disclose preheating, and is directed toward a shift catalyst and has a different oxidic support, while Klein does not disclose an autothermal reforming process. Accordingly, there is no motivation to combine the references in such a way to obtain the claimed invention. Therefore, it is respectfully submitted that the claims are not obvious under 35 U.S.C. §103. Applicants request withdrawal of this rejection.

Response to Second Rejection Under 35 U.S.C. § 103(a)

Claims 7-9 and 11-16 are rejected under 35 U.S.C. §103(a) as being unpatentable over Chintawar and Klein and either Choudhary U.S. Patent No. 6,293,979 or Fujitani U.S. Patent No. 4,367,166. Applicants respectfully traverse this rejection for reasons made of record in the response filed October 28, 2003.

As stated above, neither Chintawar nor Klein disclose, teach or suggest an autothermal process or a catalyst for use in the process that involves preheating a

reactant mixture containing hydrocarbons, oxygen and water and then b) passing the preheated mixture over the catalyst that is operated adiabatically.

With regard to Choudhary, this reference discloses a process for methane or natural gas conversion using improved supported catalysts containing oxides of nickel and cobalt with or without precious metals. See summary of invention col. 4, lines: 53-59:

This invention provides a catalytic process for conversion of methane or natural gas to syngas or a mixture of carbon monoxide and hydrogen in a most energy efficient manner in a fixed bed adiabatic or non-adiabatic reactor using an improved supported catalyst containing oxides of nickel and cobalt, with or without noble metals.

Choudhary does not deal with autothermal catalytic steam reforming of hydrocarbons in fuel cell technology, but in a fixed bed reactor of large industrial scale. Moreover, the catalyst disclosed in Choudhary contains oxides of nickel and cobalt, which are not the claimed oxidic support materials of aluminum oxide, silicon dioxide or mixed oxides thereof or zeolites as presently claimed.

Further, Choudhary discloses that cerium (chemical formula = Ce) in the elemental state as the metal in combination with other metals such as Pt, Rh, Ir, Ru, *etc.* (col. 1, lines 41-50). Choudhary does not disclose cerium oxide ("ceria," chemical formula = Ce_2O_3 and/or CeO_2) as recited in pending claims 7 and 8.

Fujitani discloses a catalyst for conventional steam reforming, consisting of cerium oxide and rhodium. The support material is a conventional pellet carrier or a porous body, which is impregnated with cerium nitrate and rhodium nitrate and then calcined (example 1). Fujitani clearly does not disclose, teach or suggest an autothermal process or a catalyst for use in the process that involves preheating a reactant mixture containing hydrocarbons, oxygen and water and then passing the preheated mixture over the catalyst that is operated adiabatically. Moreover, Fujitani does not disclose, teach or suggest the claimed oxidic support

material selected from the group consisting of aluminum oxide, silicon dioxide, or mixed oxides thereof or zeolites.

Since none of the cited references disclose, teach or suggest the present claims that include preheating the reactant mixture and passing it over the catalyst adiabatically, and the claimed catalyst is not disclosed in the cited references, then the present claims cannot be considered obvious. Moreover, there is no motivation to combine the references in such a way to obtain the claimed invention. Therefore, it is respectfully submitted that the present claims are not obvious under 35 U.S.C. §103(a). Applicants request withdrawal of this rejection.

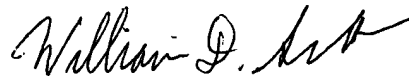
Conclusion

Applicants believe that the present application is in condition for Allowance. Entry of amendment, and reconsideration of the application is respectfully requested.

If any additional fees are due, or an overpayment has been made, please charge, or credit, our Deposit Account No. 11-0171 for such sum.

If a telephone conference would be of assistance in furthering the prosecution of the application, Applicants' undersigned attorney requests that she be contacted at the telephone number provided below.

Respectfully submitted,



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